Contributions to the Knowledge of the Pacific Species of *Antithamnion* and Related Algae[1]

Jun Tokida and Tadaaki Inaba[2]

The junior author, T. Inaba, expert of the Fisheries Department of Fukui prefectural government, was able to make collections of marine algae along the coast of Bōsō Peninsula lying southeast of Tokyo Bay, during the time he was engaged as a teacher in the Awa Suisan-Gakkō (School of Fisheries) in Tateyama City, Chiba prefecture. This is a most interesting coast for phycologists, offering many kinds of temperate-zone seaweeds, and, of course, has already been frequently botanized by many other persons. Nevertheless, further effort in searching there for new or rare species seems to be quite promising in view of the fruitfulness of the junior author's collections, especially those made in the spring of 1944. Partial results of our studies on the species of *Antithamnion* and its allied genera which were thus discovered are reported here.

The text figures 1*a*, 1*b*, 4, 5*a*, 5*b*, and 10*a* are reproduced from the drawings by Inaba, while the rest are from those of Tokida. Figures 6 and 8 are reproduced from photograph negatives obtained by projecting on bromide papers with an enlarging camera the images of the specimens mounted in glycerine on a glass slide.

It will not be superfluous to give here an explanation of the technical terms used in our descriptions. By the terms "ramus" or "branch," "pinna," "pinnula," and "ramulus," we intend to express the different orders of the successive branching system in *Antithamnion* and its allied genera. The ramus, being provided with a meristem at its top, is the direct offshoot of the main axis of the frond and bears pinnae. Pinnae, in *Antithamnion,* are usually opposite or sometimes whorled offshoots on each segment of the main and branch axes, simple or divided, bearing, in the latter case, pinnulae. Pinnulae, in *Antithamnion,* are opposite, alternate, or secund on the pinnae, arising usually singly or rarely by pairs from some segments of the axis of pinnae. Ramuli are usually simple offshoots arising singly from some segments of the axis of pinnulae. By "ultimate ramuli," however, we do not always mean ramuli but sometimes mean either pinnulae or pinnae according to the extent of intricacy of the branching system.

The senior author wishes to acknowledge his indebtedness to Mme. Valerie May for her kindness in sending him a fragment of an authentic specimen of *Acrothamnion pulchellum* J. Ag., and to Dr. E. Yale Dawson of the University of Southern California for his kindness in sparing from his library valuable publications helpful for the present study.

Antithamnion basisporum Tokida and Inaba, sp. nov.

Figs. 1*a–c*; 2*a–d*

Fronde sparse ramosa et opposite pinnata; axibus principalibus inferne repentibus, rhizoidibus brevissimis et simplicibus, 16–26 μ crassis, a cellulis basalibus pinnarum emit-

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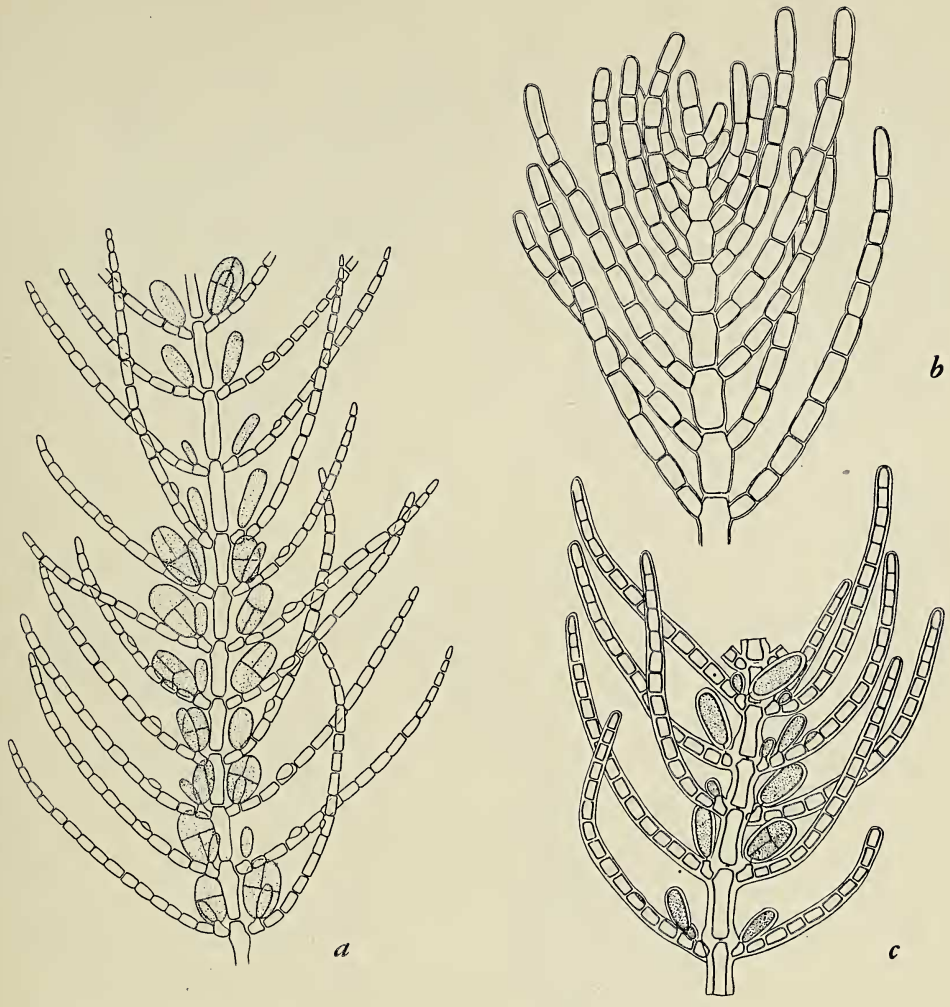

FIG. 1. *Antithamnion basisporum* Tokida and Inaba, sp. nov.: *a*, middle portion of a main branch, showing tetrasporangia and gland cells; *b*, apical portion of a main branch; *c*, part of a branch, showing that two of the pinnae bear a sporangium on each of two lowest cells, and that one pinna bears on its lowest cell a pinnula together with a sporangium. *a* and *c*, × 150; *b*, × 350.

tentibus adfixis, superne erectis et ca. 2 mm. altis; ramis in plerusque a cellulis basalibus pinnarum vel raro a cellulis axialibus ramorum ipsis emittentibus, usque ad 20–32 μ crassis, cellulis diametro 1–4-plo longioribus; pinnis simplicibus vel raro semel divisis, apice rotundatis, 7–14 (–16)-cellularibus, usque ad 14 μ crassis, cellulis diametro 1–3-plo longioribus, cellulis glandulinis supra unam cellulam lateraliter sitis ornatis; chromatophoris paucis, taeniatis; tetrasporangiis in cellulis basalibus pinnarum sessilibus, 28–38 μ × 56–64 μ, cruciatim divisis; spermatangiis et ramulis carpogonatis ignotis.

Frond sparsely branched and oppositely pinnate; main axis creeping below, attached to the substratum by means of short, simple rhizoids, 16–26 μ diam., arising from the basal cells of pinnae, erect above, ca. 2 mm. high; branches usually produced from the basal cells of pinnae or rarely from the axial cells of the main branch itself, up to 20–32 μ

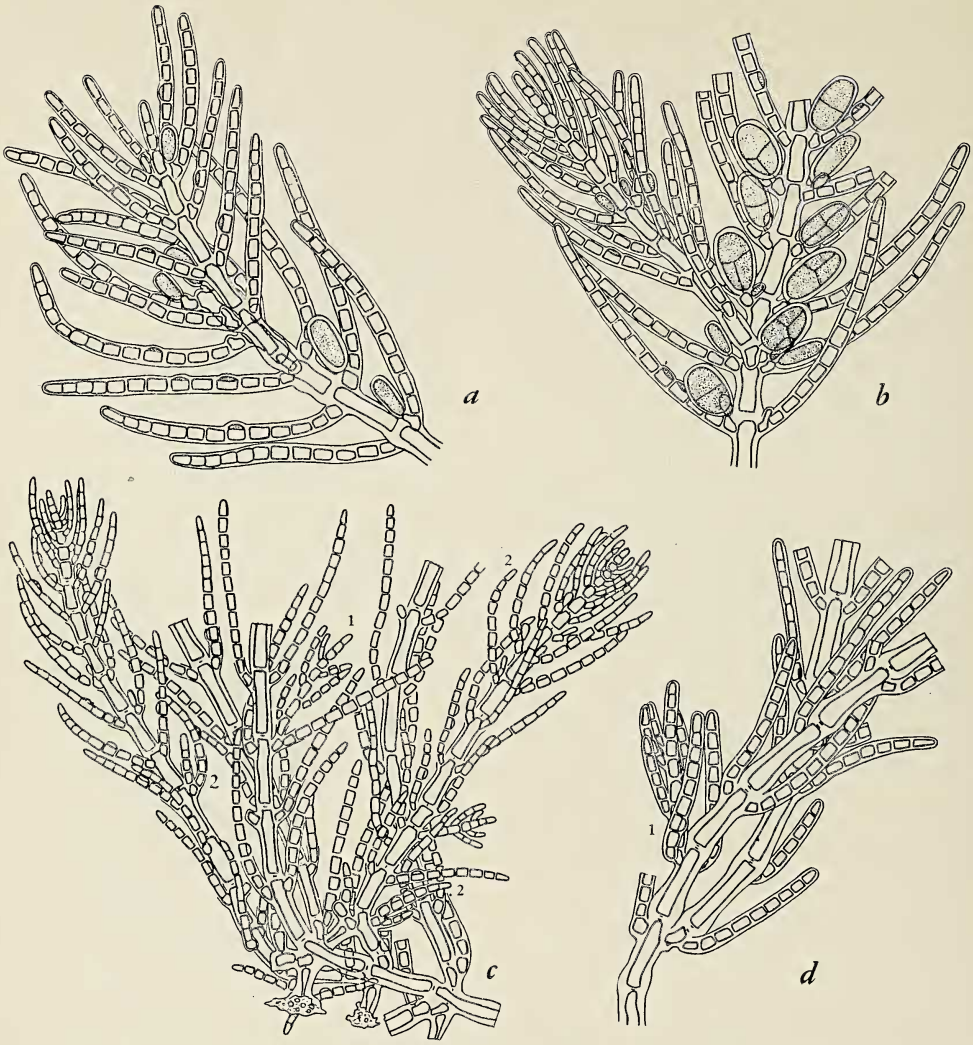

FIG. 2. *Antithamnion basisporum* Tokida and Inaba, sp. nov.: *a* and *b*, mode of branching in the upper portion of a frond; *c* and *d*, mode of branching in the lower portion of a frond and young branches arising from the lowest cell of the pinna (1); *c*, rhizoidal filaments: three pinnae which bear on their lowest cells a short pinnula (2), and the branch apices, are also shown. *a*, *b*, and *d*, × 150; *c*, × 137.

diam., with cells 1–4 diameters long; pinnae simple or rarely once divided, rounded at apices, 7–14 (–16)-celled, up to 14 μ diam., with cells 1–3 diameters long, provided with gland cells which sit singly on the upper lateral side of the cell; chromatophores a few bands; tetraspores sessile on the basal cells of pinnae, 28–38 μ × 56–64 μ, cruciately divided; sexual reproductive organs unknown.

Japanese name: NIRETSU-KASANEGUSA (nom. nov.).

Type: Growing on pebbles, Mera, Prov. Bōshū. *T. Inaba 401*, Apr. 10, 1944 (Herbarium, Dept. Fish., Hokkaido Univ.).

This species of *Antithamnion* is one of those bearing simple pinnae. It differs from many of the allied species, e.g., *A. glandulíferum* Kylin, *A. pacificum* (Harv.) Kylin, *A. Gardneri* De Toni, etc., in having one to two tetrasporangia on the lowermost cell of

the pinnae, while it resembles in this respect *A. Miharai* Tokida (Tokida, 1942: 90, text figs. 5 and 6). The last-mentioned species differs from our new species in having tetrasporangia not only on the lowermost cell but also on two succeeding cells. The most striking character of the present species seems to be that the tetrasporangia are arranged in a longitudinal row along each side of the axis of branches. The cell next to the lowermost cell of pinnae rarely bears a sporangium. In the lower part of the frond a branch is produced by the basal cell of a pinna, and sometimes it lacks an adaxial pinna on its lowermost cell, while in the upper part of the frond a branch is formed directly from the axial cell of the main branch and is provided with a short basal cell which bears no pinna but occasionally bears a sporangium. The cell next to the basal cell of a branch in the upper part of the frond sometimes lacks an adaxial pinna. The pinnae are as a rule simple, but rarely they bear a small pinnula on their lowermost cell. A pinnula of this kind is probably nothing but the beginning of a branch.

Antithamnion cristirhizophorum

Tokida and Inaba, sp. nov.

Figs. 3*a–d*, 4

Fronde ca. 5 mm. alta, sparse ramosa et opposite pinnata, repenti, rhizoidibus cristatis a cellulis basalibus pinnarum emittentibus ramis aliae algae ut *Ceramii* sp. et *Gelidii subcostati* adfixa; ramis a cellulis basalibus pinnarum emittentibus, usque ad 120–150 μ crassis, inferne cellulis diametro 1.5–3.5-plo, superne 0.5–2-plo, longioribus, cellulis apicalibus 8 μ crassis; pinnis lanceolatis, cellulis ad septa leve constrictis, cellulis basalibus subquadratis et usque ad 64 μ crassis, inferioribus diametro 1–2-plo longioribus et usque ad 80 μ crassis, apice subulatis, inferne pinnatis, superne inferiore latere pectinatis; pinnulis simplicibus vel raro semel divisis, inferne 20–52 μ crassis, cellulis diametro 1–1.5-plo longioribus, apice subulatis; cellulis glandulinis numerosis, 22–40 $\mu \times$ 15–32 μ, in pinnulis brevioribus singulatim supra cellulas tres sitis; chromatophoris numerosis, disciformibus. Fructus ignoti.

Frond ca. 5 mm. high, sparsely branched and oppositely pinnate, creeping on the branches of other algae, such as *Ceramium* sp. and *Gelidium subcostatum,* by means of crested rhizoidal filaments arising from the basal cells of pinnae; branches produced from the basal cells of pinnae, up to 120–150 μ diam., with lower cells 1.5–3.5 and upper cells 0.5–2 diam. long, and apical cells 8 μ diam.; pinnae lanceolate, slightly constricted at septa, the basal cells being subquadrate and up to 64 μ diam., lower cells being 1–2 diam. long and up to 80 μ diam., subulate at apices, pinnate below, pectinate on the lower side in the upper portion; pinnulae simple or rarely once divided, 20–52 μ diam. below, with cells 1–1.5 diam. long, subulate at apices; gland cells abundant, 22–40 $\mu \times$ 15–32 μ, sitting singly over three cells on short pinnulae; chromatophores numerous discs. Reproductive organs unknown.

Japanese name: FUSANE-KASANEGUSA (nom. nov.).

Type: Epiphytic on other algae, e.g., *Gelidium subcostatum* Okamura and *Ceramium* sp., Shirahama, Prov. Bōshū. *T. Inaba 350,* Mar. 11, 1944 (Herbarium, Dept. Fish., Hokkaido Univ.).

This species of *Antithamnion* is one of those bearing gland cells of the scaphoid type, or those resting laterally on two or three cells. The frond is repent on the thallus of other algae, such as *Gelidium subcostatum* and *Ceramium* sp., and is attached by means of short crested rhizoidal filaments arising from the lowermost cells of pinnae. The pinnae and pinnulae are lanceolate, being sharply acute at the apex, somewhat thickened in the middle portion, and slightly attenuated toward the base. The pinnulae are

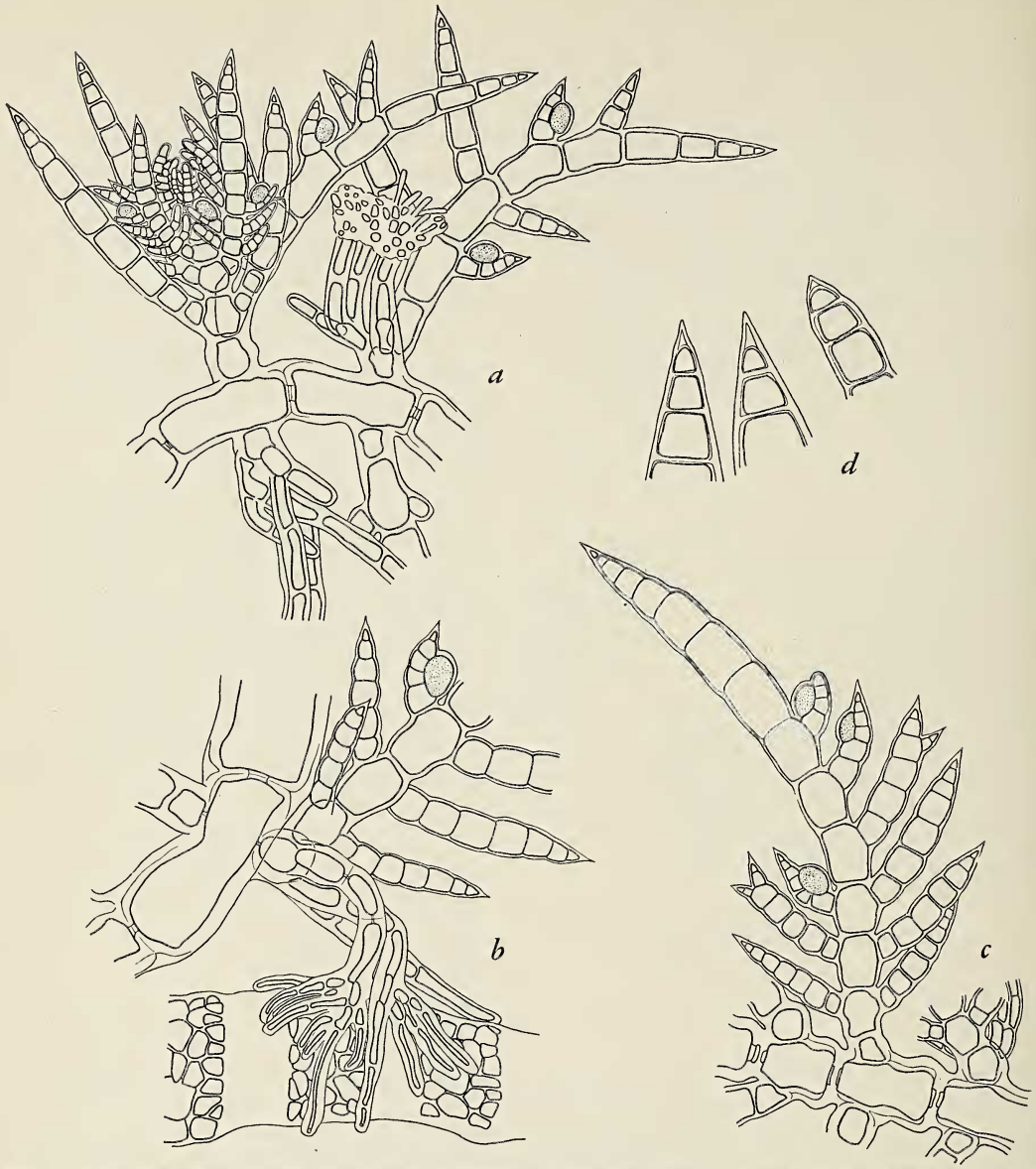

FIG. 3. *Antithamnion cristirhizophorum* Tokida and Inaba, sp. nov.: *a,* part of the lower portion of a frond, showing rhizoidal filaments, gland cells, and a young branch; *b,* the same, showing a tuft of rhizoidal filaments attached to a branch of *Ceramium* sp.; *c,* a pinna bearing nine pinnulae, two of which are once-divided pseudo-dichotomously near the tip; *d,* the tips of three ultimate ramuli. *a* and *c,* × 137; *b,* × 150; *d,* × 480.

usually simple, but rarely pseudo-dichotomously divided at their apices.

Platythamnion horridum Tokida and Inaba, sp. nov.

Figs. 5*a, b*; 6*a–d*; 7*a–d*

Fronde usque ad 2 cm. alta, subdichotome repetite ramosa, pinnis quaternis dense verticillata; pinnis lateralibus maturis brevissimis, 80–200 μ longis, ad basin 22–46 μ crassis, axibus 5–7-cellularibus, oblanceolatis, superiore latere pectinatis, in inferiore parte binis seriebus pinnularum ramosorum ornatis, cellulis basalibus inferiore latere nonnum-

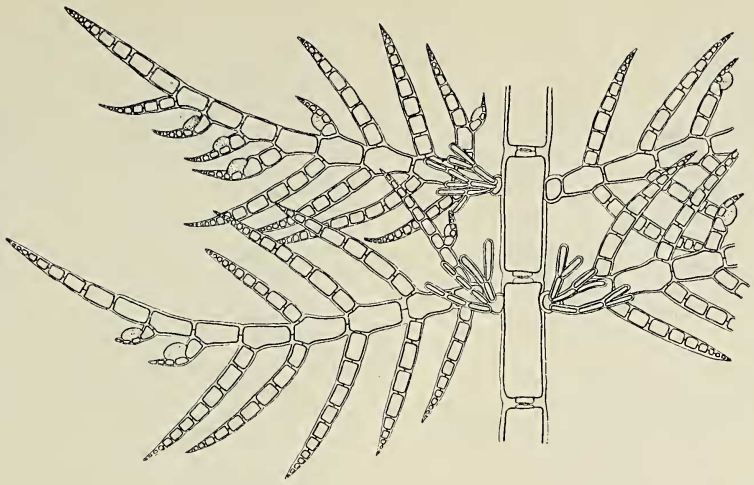

FIG. 4. *Antithamnion cristirhizophorum* Tokida and Inaba, sp. nov. Middle portion of a main branch showing pinnae, pinnulae, gland cells, and rhizoidal filaments. × 100.

quam etiam pinnula singula simplici vel ramoso ornatis; pinnis transversalibus lateralibus minoribus, irregulariter ramosis; pinnulis ultimis subulatis, cellulis apicalibus ca. 5 μ crassis; ramis principalibus usque ad 120–160 μ crassis, cellulis diametro 1–3-plo longioribus, cellulis apicalibus 14 μ altis, 10–12 μ crassis, cellulis basalibus superiore (interiore) latere plerumque nulla pinna laterali ornatis; cellulis glandulinis numerosis, supra unam cellulam lateraliter sitis, usque ad 34 μ × 30 μ; chromatophoris numerosis, taeniatis; rhizoidibus a cellulis basalibus pinnarum inferiorum emittentibus, 10–30 μ crassis; tetrasporangiis in pinnis sessilibus, 36 μ × 34 μ, cruciatim divisis; spermatangiis et ramulis carpogonatis ignotis.

Frond up to 2 cm. high, repeatedly subdichotomously branched, with whorls of four pinnae; the two lateral pinnae in mature stages very short, 80–200 μ long, 22–46 μ diam. at the base, with 5–7-celled axis, which is oblanceolate, pectinate on the upper side, with two rows of branched pinnulae in the lower portion, sometimes with also a single pinnula, simple or branched, on the lower side of the basal cell; the two transverse pinnae smaller than the lateral ones, irregularly branched; ultimate pinnulae subulate, ca. 5 μ diam. at the apex; main branches up to 120–160 μ diam., with cells 1–3 times as long as broad, apical cells 14 μ long, 10–12 μ diam., basal cells usually with no lateral pinna on the upper (inner) side; gland cells numerous, sitting laterally on one cell, up to 34 μ × 30 μ; chromatophores numerous narrow bands; rhizoids produced from the basal cells of lower pinnae, 10–30 μ diam.; tetrasporangia sessile on pinnae, 36 μ × 34 μ, cruciately divided; sexual organs unknown.

Japanese name: ONI-NO-YOTSUBAGUSA (nom. nov.).

Type: Growing on the shells of *Ostrea,* collected off the shore near the Fisheries School, Tateyama, Prov. Bōshū. *T. Inaba 403,* Apr. 18, 1944 (Herbarium, Dept. Fish., Hokkaidō Univ.).

One of the leading characters of this new species is that the larger (pinnae laterales) of the two pairs of pinnae is comparatively short, usually 1–1.5 times, but rather rarely more than two times, as long as the diameter of the cells of the main axis. Since both the lateral and transverse pinnae are short and adorned with ultimate ramuli, which are sharply acute at their apices as in other

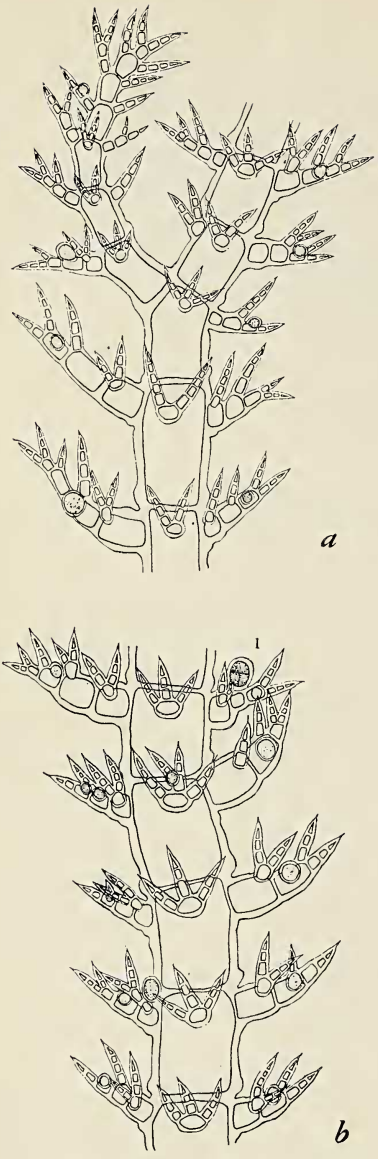

FIG. 5. *Platythamnion horridum* Tokida and Inaba, sp. nov.: *a*, middle portion of a frond, showing the mode of branching, pinnae laterales, pinnae transversales, and gland cells; *b*, the same, showing a tetrasporangium (1). *a* and *b*, × 150.

known species of the genus, the main axis looks as if it bore verticillate spines on each segment, and the frond presents as a whole a quite spiny appearance. The specific name as well as the Japanese name is given with reference to this appearance. The frond is

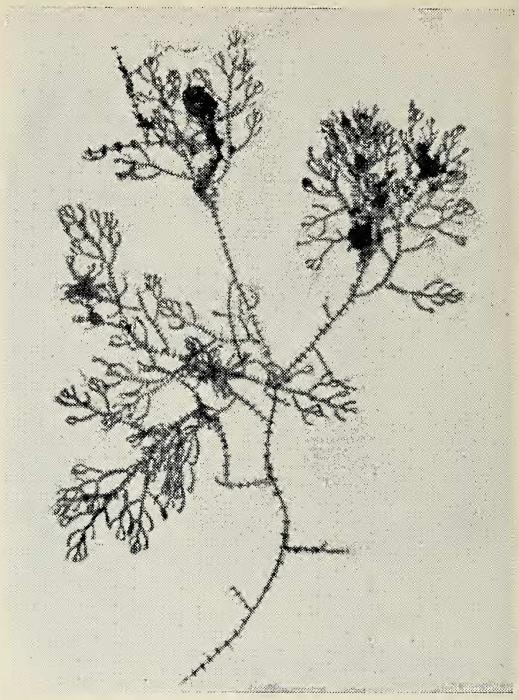

FIG. 6. *Platythamnion horridum* Tokida and Inaba, sp. nov. Type specimen. × 4.

subdichotomously branched, and the branches often lack an adaxial lateral pinna on their lowermost cell. In these respects our species does not differ from other known species of *Platythamnion* (cf. Kylin, 1925: Fig. 34*a*; Tokida, 1942: Fig. 8*b*).

Acrothamnion pulchellum[3] J. Agardh

Figs. 8; 9*a–e*; 10*a–f*; 11

J. Agardh, Analecta Algologica, p. 25, pl. 1, figs. 6–10, 1892; De Toni, Sylloge Algarum, 6: 451, 1924 *(nomen)*. (*non Acrothamnion pulchellum* as interpreted by Yendo [Notes on Algae new to Japan, V. In: Bot. Mag. Tokyo 30 (355): 262, 1916] and by Yamada [Marine Algae of Mutsu Bay, II.

[3]In accordance with Article 61 of the International Rules of Botanical Nomenclature the specific epithet *pulchellum* is not available for transfer, since *C. pulchellum* Harvey (1855) was invalidated by *C. pulchellum* C. Agardh (1828).

FIG. 7. *Platythamnion horridum* Tokida and Inaba, sp. nov.: *a*, apical portion of a frond, showing the growing apex; *b*, part of lower portion of a frond, showing the base of a branch, the lowest cell of which lacks the adaxial pinna (1); *c*, three pinnae laterales, showing pinnulae; *d*, tips of two ultimate ramuli. *a*, × 245; *b* and *c*, × 150; *d*, × 480.

In: Sci. Rep. Tohoku Imp. Univ., 4th Ser. Biol., 3(4): 528, Fig. 22, 1928]).

Syn. Callithamnion pulchellum Harvey. Some account of the marine botany of the colony of Western Australia. Trans. Royal Irish Academy, 22: 561, 1855; Phycologia Australis 5: Synoptic Catal., p. liv. no. 692, 1863; J. Agardh, Sp. Alg., 3(1): 20, 1876; De Toni, *loc. cit.*, 4(3): 1338, 1903; A. H. S. Lucas & Florence Perrin, The seaweeds of South Australia, II. The red seaweeds, p. 333, 1947. (*non Callithamnion pulchellum* C. Agardh, Sp. Alg., 2: 175, 1828).

Frond 5–10 mm. long, epiphytic on the thallus of *Gelidium subcostatum*, sparsely branched, partly repent, attached to the substratum by means of rhizoids arising from the basal cell of the lower, and sometimes also upper, pinnae; lateral branches arising from the basal cell of the pinnae, axial cells of the branches 37–60 μ diam. and 1.2–3 times as long as broad below, 60–86 μ diam. and 2.5–3.5 times as long as broad above, and 1–2 times as long as broad in the subapical portions, often provided with three pinnae; lateral pinnae opposite, 120–345 μ long, with opposite pinnulae on each segment except the basal; pinnulae simple or rarely once divided, attenuate but not acute toward the apices, composed of subquadrate cells slightly constricted at their septa, 10–20 μ diam. at the base, 5–10 μ diam. at the apical cells;

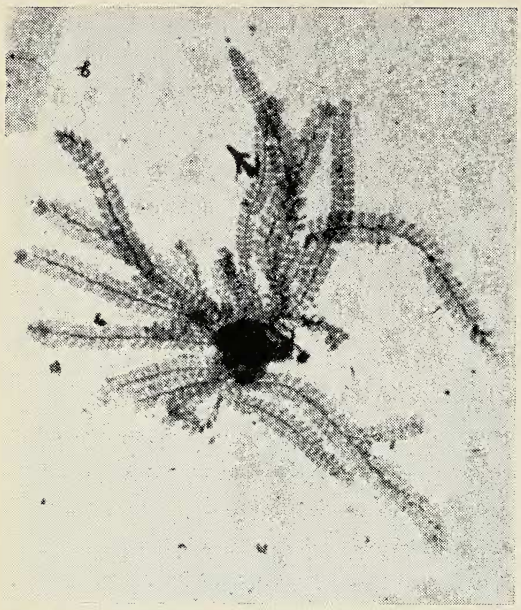

FIG. 8. *Acrothamnion pulchellum* J. Ag. Specimen from Shirahama. × 6.

axes of pinnae 25–30 μ diam. at the basal, 35 μ diam. at the suprabasal, and 20μ diam. at the subapical cells; transverse pinnae secund, smaller than the lateral ones, 72–280 μ long, 10–20 μ diam., simple or sparsely pinnulate above, in the latter case provided with opposite pinnulae on the apical segment and sometimes also with opposite or secund pinnulae on the subapical segments; gland cells always on the apices of pinnae and pinnulae, sitting between the two apical pinnulae on two basal cells of either of them, 10–20 μ high, 20–25 (–30) μ diam.; chromatophores discoid, numerous. Sexual reproductive organs unknown; tetrasporangia observed on a specimen from Western Australia.

Japanese name: KUJAKU-HANEMO (nom. nov.).

Specimen: Growing on the thallus of *Gelidium subcostatum* Shirahama, Prov. Bōshū *T. Inaba 351,* Mar. 11, 1944 (Herbarium, Dept. Fish., Hokkaido Univ.).

This beautiful species was discovered to be partly repent upon the thallus of *Gelidium subcostatum,* being attached by means of many rhizoidal filaments issuing from the lowermost cell of the pinnae at the lower portion of the frond and not uncommonly near the apical portion as well. The plant stands close to *Antithamnion* in the characters of the growing point and in the method of branching as well as in the possession of opposite pinnae on each segment of the main axis; but on the other hand it differs from that genus in having a single dwarf accessory pinna or transverse pinna on each axial segment of branches in addition to the above-mentioned opposite pinnae, and in having quite characteristic apical gland cells. The branches arise from the lowermost cell of either or both of the opposite principal pinnae. The axial segment of branches gives rise near the top to three pinnae in all, or two opposite larger pinnae and a single smaller pinna, of which the latter arises in the direction crossing at right angles with the plane including the two opposite pinnae. The smaller transverse pinnae are secund on one side of the main axis which corresponds to the side from which branches and rhizoidal filaments arise or to the underside of the repent portion of the frond. The principal pinnae bear two opposite pinnulae, as a rule, on each axial cell except the lowermost one. The number of the opposite pairs of the pinnulae for one principal pinna ranges from 5 to 11 (as indicated by our counts of many pinnae, amounting to 224 in all). The frequency of each number was as follows:

Number of pairs:	5	6	7	8	9	10	11
Frequency:	1	5	11	47	98	59	3

As can be seen in the listing above, the pinnae with nine pairs of pinnulae were most frequent in occurrence. The spread of two opposite pinnulae and that of two opposite pinnae measures 90–225 μ and 240–690 μ in width, respectively. The accessory pinnae or transverse pinnae, in the typical form, bear at least one pair of opposite pinnulae on the apical axial cell, which is crowned

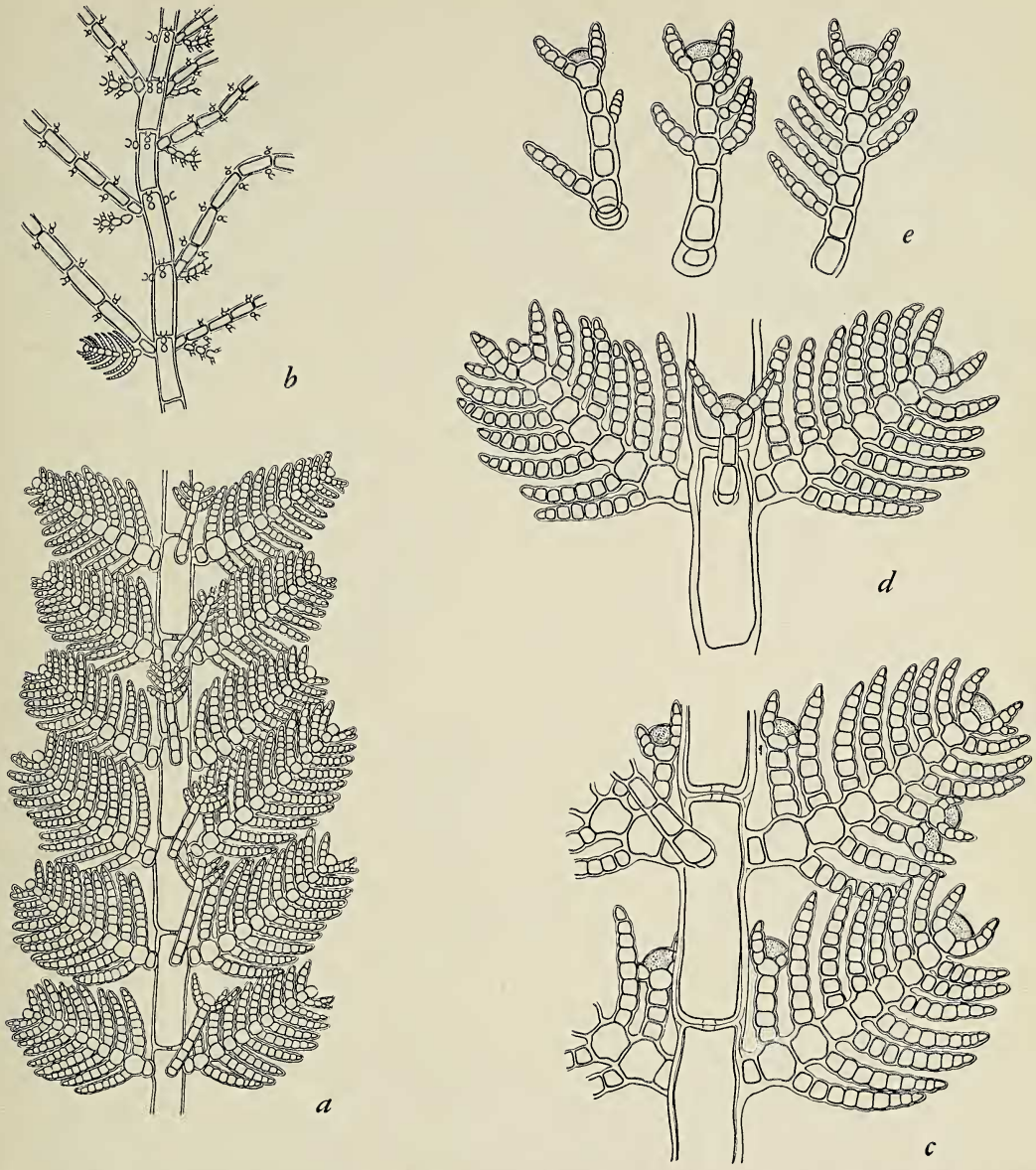

FIG. 9. *Acrothamnion pulchellum* J. Ag.: *a,* middle portion of a main branch, showing opposite pinnae laterales and secund pinnae transversales; *b,* lower portion of a frond, showing the mode of branching, details of all the pinnae but one having been omitted; *c,* six pinnulae crowned with apical gland cells; *d,* typical forms of both pinna lateralis and pinna transversalis, on the left side an exceptional pinna lacking the apical gland cell; *e,* three pinnae transversales, showing the variety of the arrangement of pinnulae. *a,* × 75; *b,* × 40; *c, d,* and *e,* × 150.

with a gland cell. The occurrence of pinnulae on the rest of the cells of the axes is irregular. Although the accessory pinnae are as a rule single on each axial cell of branches, sometimes they happen to be absent on certain axial cells or two may be formed from each axial cell. In the latter case, two accessory pinnae stand side by side on the same side of the frond axis. The pinnulae, either on the principal or accessory pinnae, are gen-

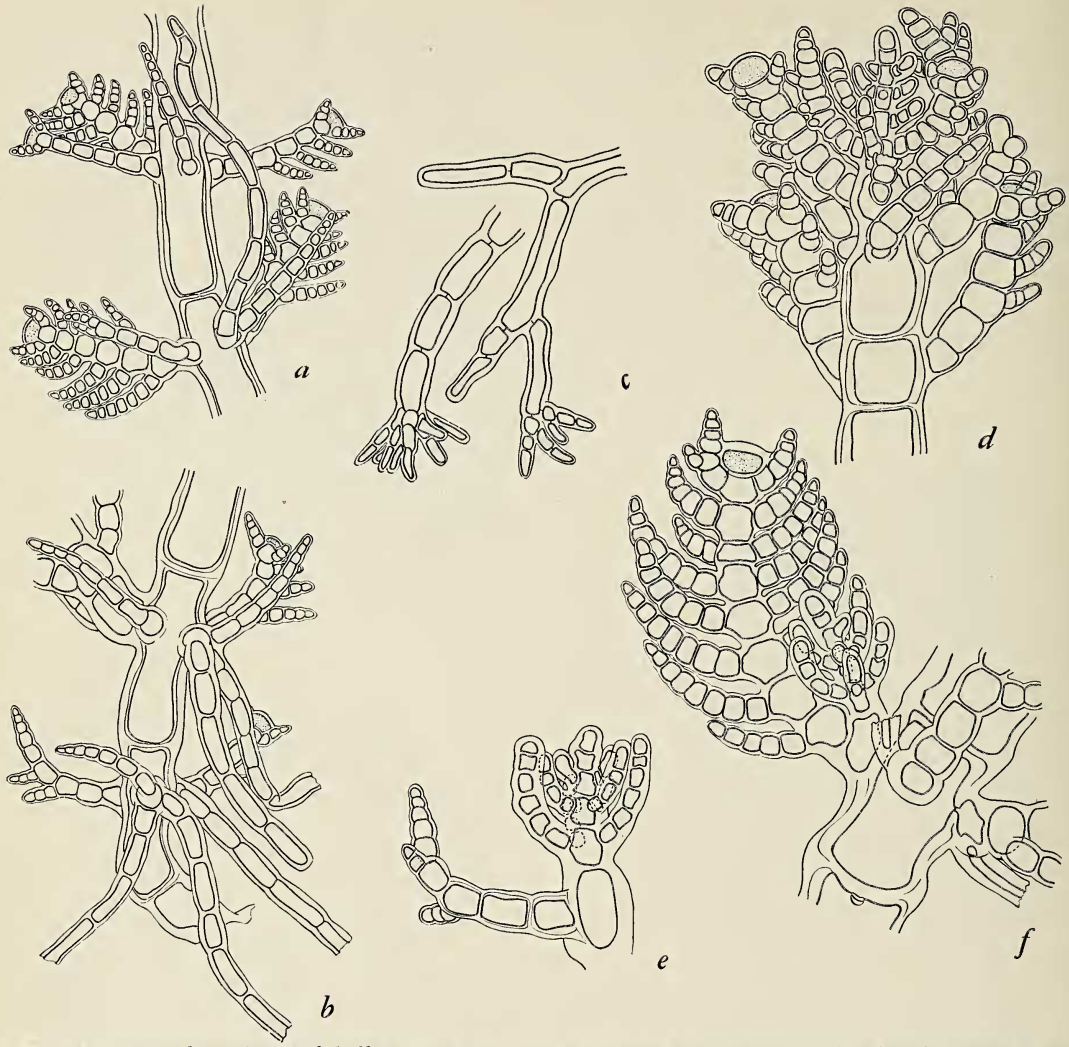

FIG. 10. *Acrothamnion pulchellum* J. Ag.: *a,* part of the lower portion of a frond, showing two pairs of pinnae transversales developing on the same side of the axis, and a rhizoidal filament arising from the lowest cell of a pinna; *b,* the same, showing rhizoidal filaments; *c,* the branching at the distal end of two rhizoidal filaments; *d,* apical portion of a short branch; *e,* very young branch developing from the lowest cell of a principal pinna; *f,* initial of a branch developing from the lowest cell of an upper principal pinna. *a* and *b,* × 150; *c, d, e,* and *f,* × 245.

erally simple, with tapering but not acute tips. Rarely some of them on a principal pinna are crowned with two opposite ramuli supporting an apical gland cell at their fork, in just the same manner as in the apex of a pinna. In the lower portion of the frond, the structure of pinnae is apt to become irregular; in other words, pinnulae often disappear partly or entirely from principal pinnae or accessory pinnae, respectively. An accessory pinna which thus remains entirely simple is no longer crowned with a gland cell. The gland cell rests solitarily at the apex of each pinna, always on five cells covering the uppermost axial cell of the pinna and two lowermost cells of each pinnula arising oppositely from the uppermost axial cell of the pinna. The principal pinnae or lateral

pinnae present a feathery appearance which reminds one of the beautiful plumes from the gorgeously eyed train of the peacock, inasmuch as they bear distichous opposite pinnulae on each axial cell (except for the basal one) and one large gland cell glittering at their apices. The Japanese name proposed for this species is based on that appearance. The reproductive organs unfortunately have not been discovered in our specimens. The description of the species given here is based upon our sterile specimens collected at Shirahama.

The writers owe the present identification to the suggestion of Prof. Y. Yamada, of the Faculty of Science in Hokkaido University, who once made a comparison of the Japanese specimens (which were then provisionally referred to *Acrothamnion pulchellum*) with Harvey's Austr. Alg., No. 539 (*Callithamnion pulchellum* Harv.), or the type specimen of *Acrothamnion pulchellum,* in Harvey's herbarium at Dublin, Agardh's herbarium at Lund, etc. (cf. Yamada and Inagaki, 1935: 37). He informed us that the authentic specimens of the species when seen under the microscope attracted his special attention by their possession of the quite characteristic apical gland cells. On the other hand, it is curious that we find no description of that organ in the diagnoses of the genus and the species given by Harvey, J. Agardh, De Toni, and Lucas & Perrin, if "*favellus*," which was described by Harvey as "favellis simplicibus rachidem plumulae terminalibus," is really comparable with the cystocarp and not with the gland cells as illustrated by J. Agardh (1892: Fig. 10) in a simple and equivocal figure. This figure seems to have nothing to do with the cystocarp but reminds us of an inflated axial cell of a pinna infected by a parasitic fungus (cf. Tokida, 1932: Fig. 5*b*). "Pinnula . . . adparenter truncata," illustrated in the same work of J. Agardh (Fig. 9), resembles quite well a simple accessory pinna lacking an apical gland cell in our Japanese plant. "Pinnulae steriles (ad *)," illustrated in Figures 6, 7, and 8, resemble abnormal lower pinnae lacking gland cells in our plant (cf. Figs. 10*b* and 10*e* in the present paper). The arrangement of the pinnae in our plant, which is distichous with two opposite compound pinnae spreading on the same plane, or, more frequently, tristichous with a more simply constructed pinna in addition to the opposite ones just mentioned, seems to agree with the description of the pinnae of *Callithamnion pulchellum* given by J. Agardh (1876), which runs as follows: "pinnis geminis conformibus distichis opposite pinnulatis, aut ternis una dispari simpliciore." As to the validity of the tetrasporangium-bearing simple and subfiliform accessory pinnula, which was described and illustrated by J. Agardh (1892: Figs. 6, 7, and 8), as a character of generic importance, we are inclined to harbour a strong doubt since we could observe sessile tetrasporangia on a fragment of Harvey's original specimen of *Callithamnion pulchellum* (Alg. Austr. Exsicc., No. 539D) through the most generous kindness of Mme. Valerie May of the Division of Fisheries, Marine Biological Laboratory, Cronulla, New South Wales, Australia. In April, 1948, the senior author received a letter from her answering his request to compare some figures of the Japanese plant drawn by himself with the authentic specimens of *Acrothamnion pulchellum* J. Ag. Mme. May kindly enclosed in her letter a fragment of Harvey's specimen deposited in the National Herbarium of New South Wales, Sydney. In examining the fragment under the microscope, it was quite satisfactorily ascertained that our Japanese plant coincides with Harvey's species in every morphological characteristic. As the fragment fortunately bears tetrasporangia, the authors wish to give here a thorough description and illustrations of them.

The tetrasporangia-bearing branch is marked by having frequently a couple of

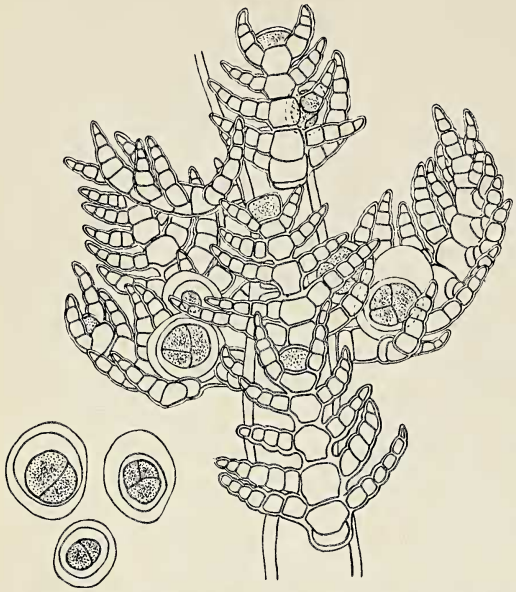

FIG. 11. *Acrothamnion pulchellum* J. Ag. Part of a tetrasporiferous fragment of Harvey's specimen (Alg. Austr. Exsicc. No. 539D) collected at Port Fairy, Victoria, in 1855, showing the sessile tetrasporangia with inflated membranes, developing on the upper side of the lower portion of the pinnae. Three sporangia in various stages of development are shown separately. × 245.

compound accessory pinnae on the ventral side of each of its segments. The sporangia mounted in glycerine-water measure 32–48 μ long and 24–44 μ wide, excluding membranes. Including the outer layer of the membrane, which is usually swollen to a remarkable extent, a sporangium is 86 μ long and 72 μ wide and contains a spore mass measuring 38 μ long and 36 μ wide. The same sporangium is 52 μ long and 48 μ wide, including the inner layer of the membrane. A young immature sporangium in which the contents are undivided and measure 20 μ by 18 μ is 38 μ long and 34 μ wide, including the inner layer of the membrane, and 60 μ long and 52 μ wide if the outer layer is included. The sporangia are sessile, standing on the adaxial (upper) side of the basal segment of, usually, the lowermost pinnule of the principal and accessory pinnae. They divide cruciately by two successive divisions, first by a transverse wall and second by two walls perpendicular to the first as well as to each other. The opposite principal pinnae are slightly bent upward and toward the dorsal side of the axis, so as to form, along with the accessory pinnae, a fence around the axis in order to protect the tetrasporangia (cf. Fig. 11).

Pleonosporium Tohyamanum

Tokida and Inaba, sp. nov.
Figs. 12*a, b*; 13*a, b*; 14*a, b*; 15*a–c*

Fronde 1–1.5 cm. alta, rhizoidibus longis et simplicibus vel ramosis, a cellulis basalibus pinnarum inferiorum deorsum vel a cellulis inferioribus axium principalium lateraliter emittentibus adfixa; axibus principalibus inferne usque ad 300–315 μ crassis, ad basin in axes nonnulus divisis, ecorticatis, cellulis diametro 1.5–3-plo longioribus, ad septa leve inflatis; ramis et pinnis alternis et distichis; cellula basali rami quadrata, pinna nulla, cellula insequenti superiore latere pinna una praedita; pinnis simplicibus vel ramosis, lineari-lanceolatis, leviter incurvis, apica obtusis, cellulis apicalibus 22–24 μ crassis, cellulis basalibus pinnarum inferiorum in ramis inferioribus inferiore latere pinnulis simplicibus vel ramosis; chromatophoris numerosis, brevibus et taeniatis; sporangiis in pinnis et pinnulis sessilibus, plerumque in latere superiore secundis, sed raro etiam in latere inferiore sparsis, ellipsoideis, 70–106 μ longis et 50–78 μ latis, sporis pluribus ornatis; antheridiis in latere superiore ramulorum ultimorum secundatis; procarpiis subterminalibus; cystocarpiis terminalibus, ramulis involucrantibus nullis; cellula glandulina nulla.

Frond 1–1.5 cm. high, attached to the substratum by means of simple or branched rhizoidal filaments, being produced downwardly from the basal cell of the lower branches or laterally from the lower segments of the main axes; main axes up to 300–315 μ diam. below, divided into several main axes near the base, uncorticated, with cells 1.5–3 times

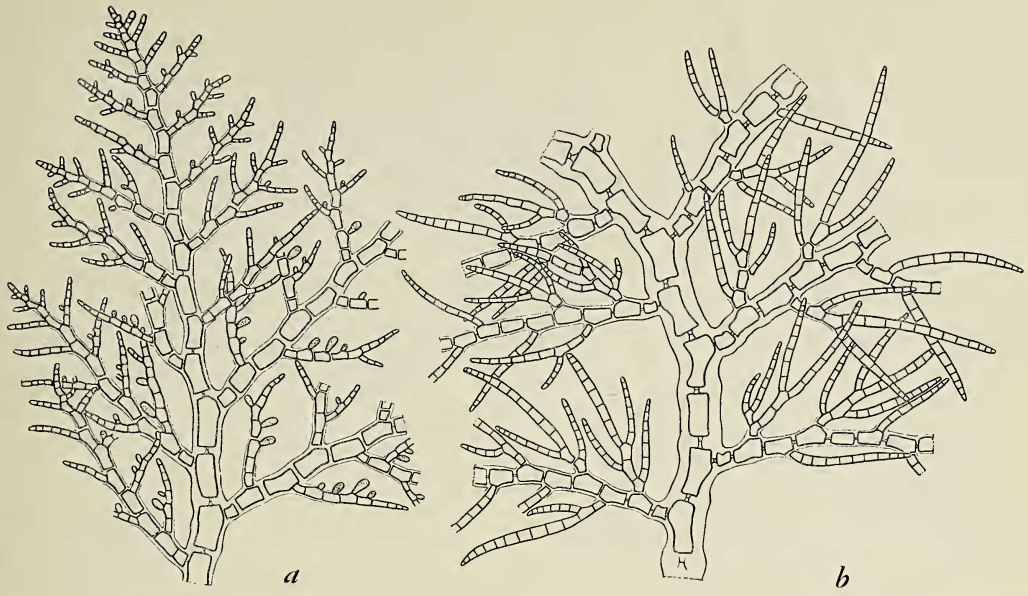

FIG. 12. *Pleonosporium Tohyamanum* Tokida and Inaba, sp. nov.: *a*, apical portion of a main axis; *b*, lower portion of a main axis, showing branching of the side branchlets on the lower segments of the branches. *a* and *b*, × 33.

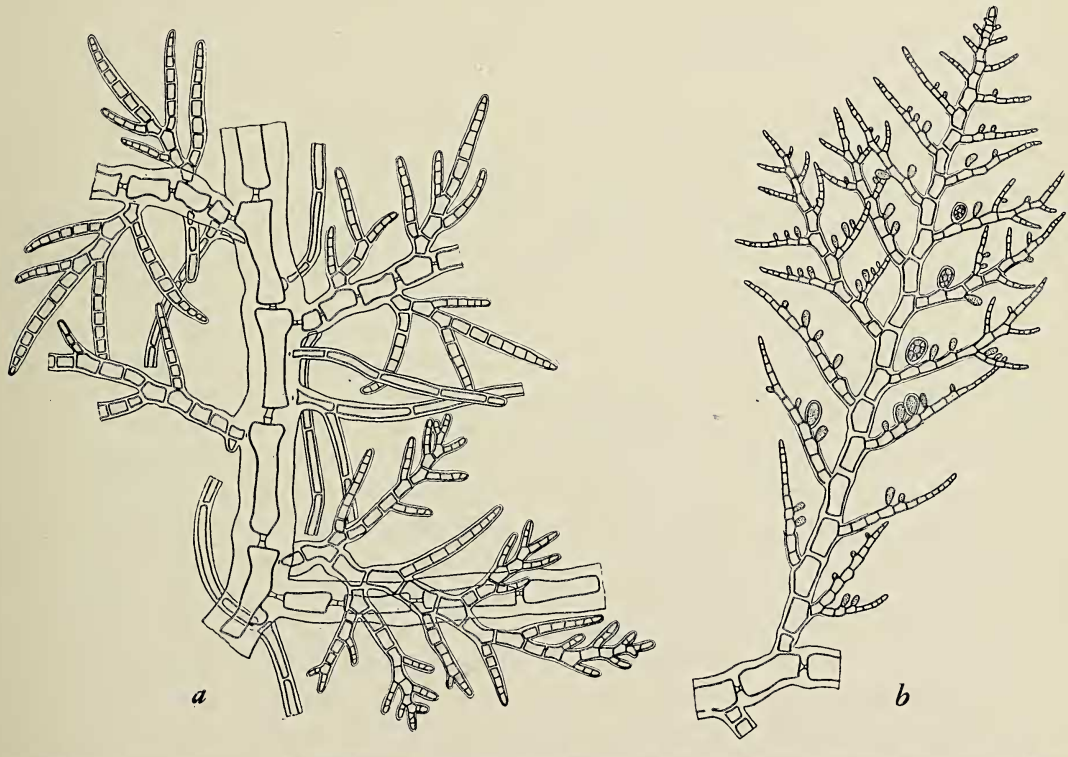

FIG. 13. *Pleonosporium Tohyamanum* Tokida and Inaba, sp. nov.: *a*, branch with sporangia; *b*, basal portion of a frond, showing rhizoids. *a*, × 40; *b*, × 65.

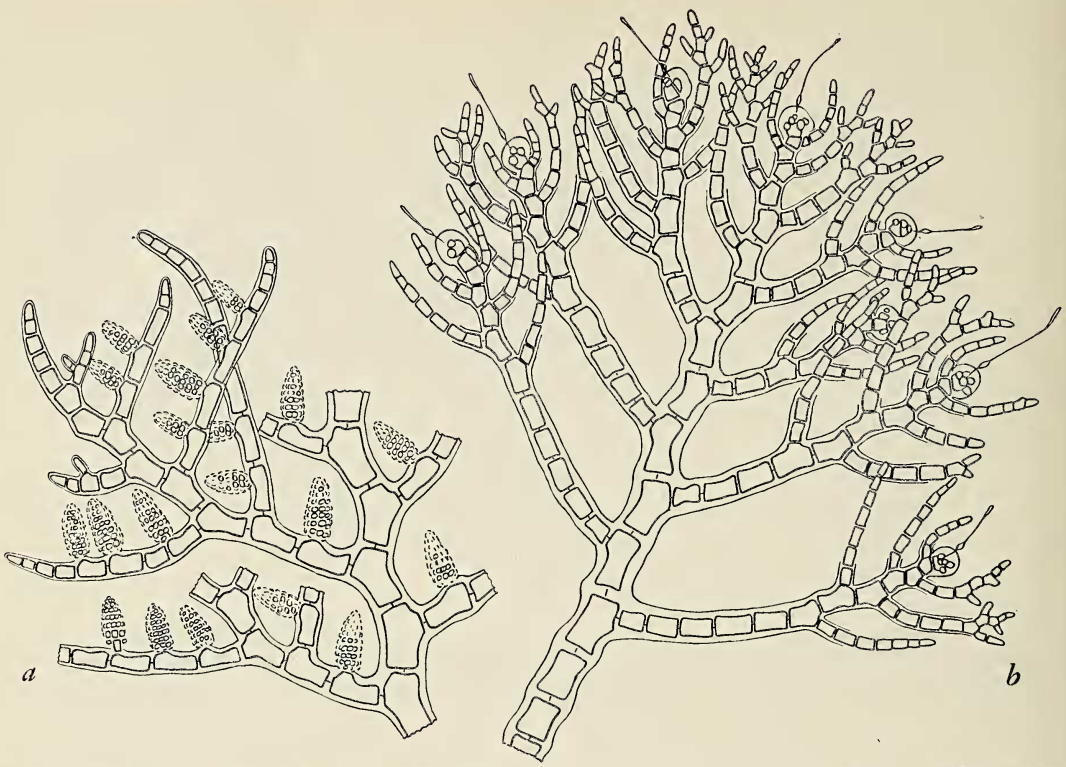

FIG. 14. *Pleonosporium Tohyamanum* Tokida and Inaba, sp. nov.: *a,* apical portion of a branch with procarps; *b,* branch with antheridia. *a,* × 150; *b,* × 98.

as long as broad, slightly inflated at joints; branches and pinnae alternate and distichous; the lowermost cell of branches quadrate, with no pinna, the next cell with a pinna on the adaxial side; pinnae simple or divided, linear-lanceolate, slightly incurved, blunt at the apex, 22–24 μ diam. at the apical cells, with a simple or divided pinnula on the abaxial side of the lowermost cell of a few lower pinnae in the lower branches; chromatophores numerous, short slender bands; sporangia sessile, usually secund on the adaxial side of pinnae and pinnulae but rarely also scattered on the abaxial side of pinnae, ellipsoidal, 70–106 μ long and 50–78 μ broad, with many spores; antheridia secundate on the upper side of the ultimate ramuli; procarps subterminal; cystocarps terminal, with no involucre; gland cell absent.

Japanese name: TOHYAMA-KUSUDAMA (nom. nov.).

Type: Growing on rocks, Mera, Prov. Bōshū. *T. Inaba 402,* Apr. 10, 1944 (Herbarium, Dept. Fish., Hokkaido Univ.).

In 1917, Yendo (1917: 91) referred a plant of *Pleonosporium* from Cape Inubō to *P. venustissimum* (Kütz.) De Toni, no doubt following the specific conception entertained by De Toni (1903), who had amalgamated *P. vancouverianum* J. Ag. with this species. Kylin (1925: 57) has disagreed with De Toni's view, stating that: "Kützing's figure (Tab. Phyc., 12: pl. 1) shows that in *C. venustissimum*[4] the side branch from the undermost cell of a branch often occurs on the upper side, but in *Pl. vancouverianum* it always occurs on the lower side." If that be the case, there arises a question as to the nature of the side branch under consideration in Yendo's plant.

[4] As a species of *Callithamnion.*

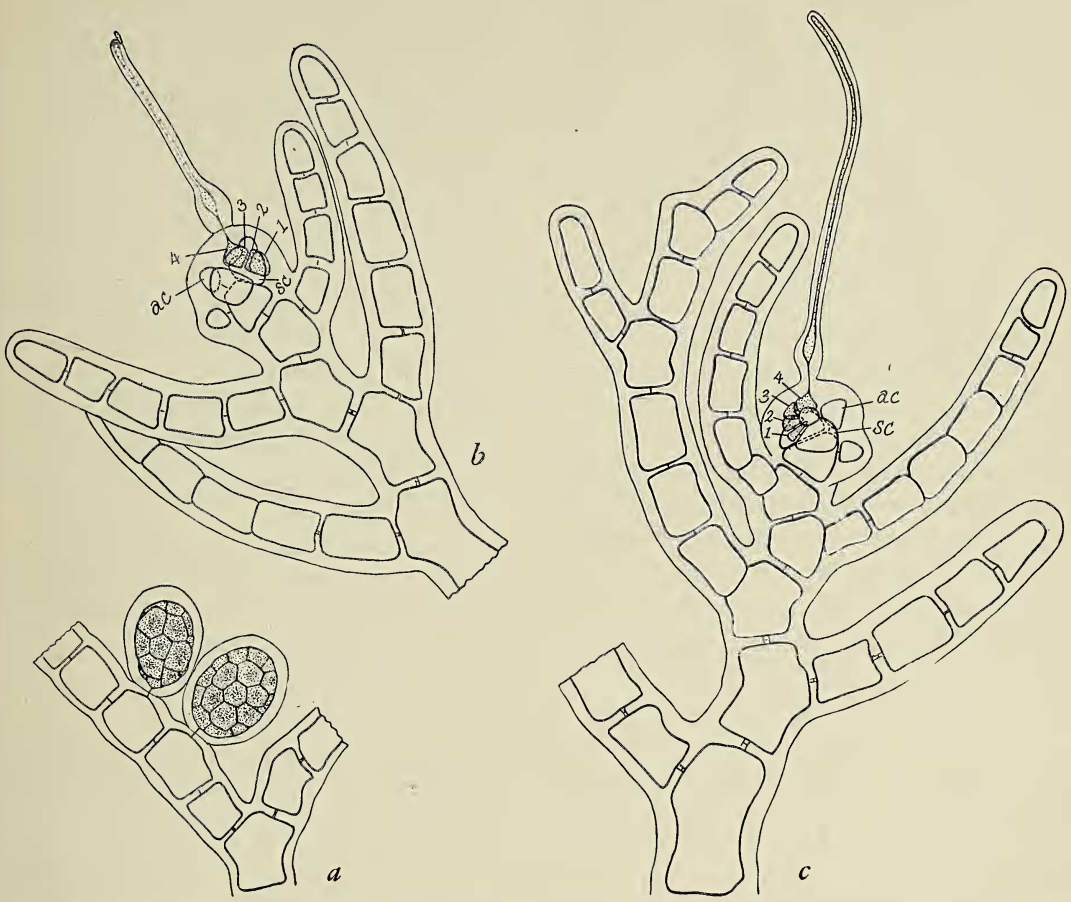

FIG. 15. *Pleonosporium Tohyamanum* Tokida and Inaba, sp. nov.: *a*, two sporangia; *b* and *c*, apical portions of fertile pinnae, showing carpogonial branches: 1, 2, 3, and 4, carpogonial branch cells; sc, supporting cell or fertile pericentral cell, provided with a carpogonial branch and a sterile cell; ac, apical cell of the pinna. *a*, × 150; *b* and *c*, × 344.

In the spring of 1944, the junior author collected a *Pleonosporium* at Mera, Bōshū province, not far distant from Cape Inubō. In general characters it resembles the two species mentioned above, but is not identical with either of them, differing in certain respects, especially in the entire absence of the side branch or pinna on the lowermost cell of a branch. The side branch on the cell next to the lowermost one arises always on the adaxial side of the branch. In this respect our plant shows a resemblance to *P. vancouverianum* rather than to *P. venustissimum*. According to the brief description by Yendo, the main branches of his plant seem to have somewhat longer cells than those of ours. As to the rhizoidal filaments. Yendo describes merely those growing downward from the basal cell of the pinnae, while our plant has in addition lateral rhizoidal filaments which issue from the lower segments of the main axis and which rarely become as thick as the main axis (Fig. 13*b*). It is quite probable that our plant is identical with Yendo's, but at present we cannot settle the question as we have had no chance to examine Yendo's original specimen. In any event, we believe the plant in question is new to science, and

we propose here to name it *Pleonosporium Tohyamanum* in honour of Mr. Nobuo Tohyama, director of the Fishery Experiment Station of Chiba prefecture, through whose kindness the authors have obtained many facilities for carrying out their phycological studies.

SUMMARY

1. In this paper is reported the discovery of four species of red seaweeds which are considered to be new to science and which belong to the genus *Antithamnion* and its allied genera in the family Ceramiaceae. The occurrence of an Australian species of the same group from the coast of Bōsō Peninsula near Tokyo Bay is also reported.

2. New species here described are as follows: *Antithamnion basisporum, Antithamnion cristirhizophorum, Platythamnion horridum,* and *Pleonosporium Tohyamanum.*

3. The occurrence in the northwestern part of the Pacific Ocean of *Acrothamnion pulchellum* J. Ag., which was originally reported from the west and south coasts of Australia in 1855, is established by comparing Japanese specimens with a fragment of Harvey's original specimen collected at Port Fairy, Victoria.

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